INTERNATIONAL DATA SCIENCES, INC.

ADVANCED TECHNIQUES IN DATA COMMUNICATIONS

MANUAL OF OPERATION FOR MODEL 65/60 BIT ERROR RATE TESTER AND EIA BREAKOUT PANEL

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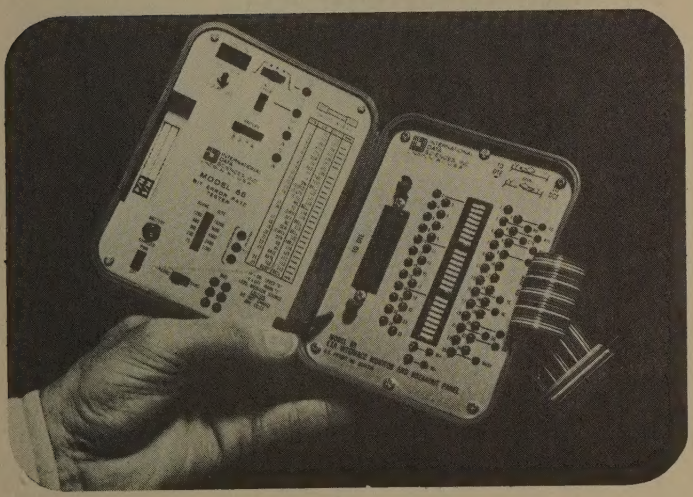
charger in test bench
by IA/Calibrator

MODEL 65/60
BIT ERROR RATE TESTER
AND
EIA BREAKOUT PANEL



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1.0 INTRODUCTION

1.1 General

International Data Sciences' Model 65/60 shown in Figure 1-1 is composed of two separate units packaged in a lightweight, pocket-size carrying case. It is designed to isolate data communications problems at the EIA RS-232 and CCITT V.24 interface. The Model 65 is a complete miniaturized modem test set capable of performing bit error rate tests on both synchronous and asynchronous communication links. The Model 60 is our familiar "Blue Box" EIA Interface Monitor and Breakout Panel, a benchmark in the industry. Together, they provide a hand-held, battery-powered unit for testing and monitoring data communications networks at the EIA modem-terminal interface.

1.2 Model 65 Description

The Model 65 Bit Error Rate Tester is a completely self-contained unit designed to perform bit error rate tests (BERT) on digital data transmission networks. It can be used to test synchronous or asynchronous modems and externally timed synchronous DCE. The Model 65 contains separate transmitter and receiver sections, allowing full-duplex tests to be performed in either end-to-end or loop-back configurations.

The transmitter continuously generates one of four switch selectable data patterns. These patterns include 63-, 511-, and 2047-bit repeating pseudo-random sequences; and an alternating mark-space pattern. Steady mark and steady space signals may also be transmitted to detect mark-to-space and space-to-mark transitions. A BERT can be performed using any of the transmitted patterns. The patterns generated are statistically optimum and accurately simulate computer generated data.

The receiver section generates a true replica of the transmitted data pattern and compares it with the received data pattern. A bit-by-bit comparison is then performed, and any detected bit errors are counted and displayed on a three-digit LED readout. An overflow is indicated whenever the count exceeds 999. If the receiver loses synchronization with the received data pattern, the LED display will indicate an overflow. Resynchronization is accomplished at the touch of a button.

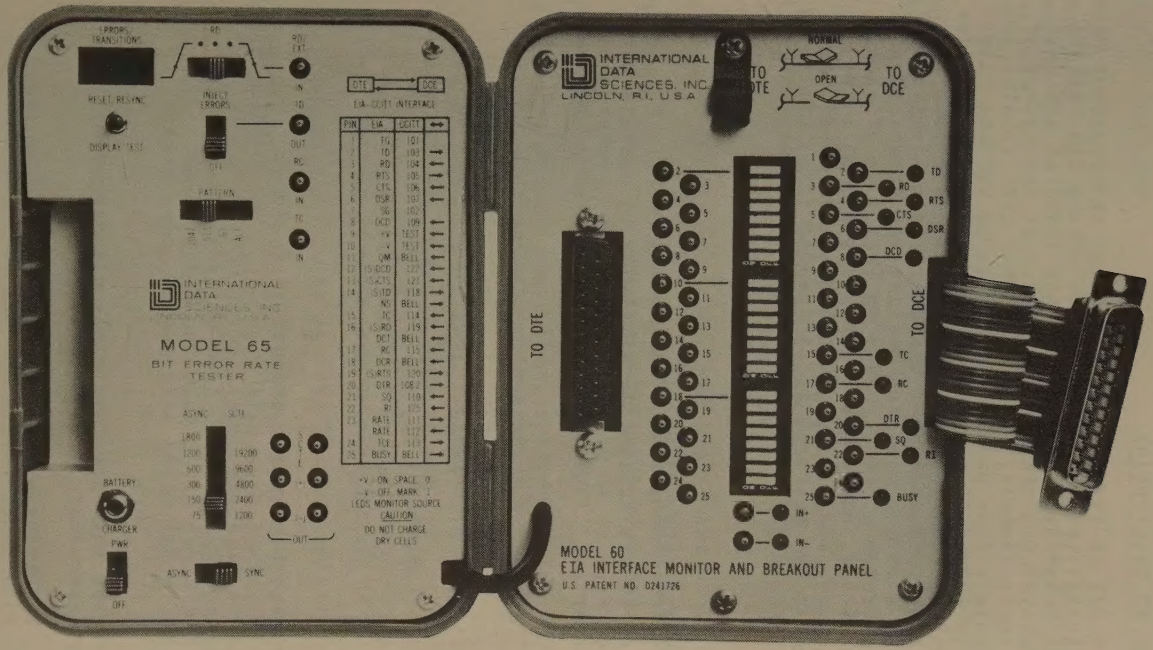


Figure 1-1. IDS Model 65/60

1.3 Model 60 Description

The Model 60 EIA Interface Monitor and Breakout Panel provides access to all 25 conductors of the EIA RS-232/ CCITT V.24 interface between the data terminal and data modem. Twelve LEDs monitor the status at the source of twelve primary signals. Two additional LEDs labeled IN+ and IN- sense either positive or negative voltage levels between ±3V and ±25V and may be used to monitor any line. Twenty-four miniature switches allow all interface conductors (except frame ground on Pin 1) to be individually interrupted allowing isolated testing and observation of terminal or modem signals. Pins on each side of each switch and small jumper cables are provided to allow cross-patching, monitoring, and testing of all signals. Thus, signals can be rerouted by opening lines utilizing the miniature switches and cross-patching utilizing the jumpers.

1.4 AC Adaptor/Charger Units

Two units are optionally available to operate the Model 65/60 from an AC power source and to recharge the Ni-Cad batteries. These units are specified as follows:

a) Model 22 AC Adaptor/Charger:

Input: 115 VAC, 60 Hz
Output: 18.2 VDC, 75 mA

b) Model 23 AC Adaptor/Charger:

Input: 230 VAC, 50 Hz
Output: 18.2 VDC, 75 mA

To charge batteries, proceed as follows:

1. Switch Model 65/60 power switch OFF.
2. Disconnect Model 65/60 from external equipment.
3. Plug the Model 22/23 into the Model 65/60.
4. Plug the Model 22/23 into the AC power source.

Batteries that are completely discharged will fully charge in approximately 16 hours.

CAUTION: Excessive overcharging may result in lower life expectancy of Ni-Cad batteries.

The Model 65/60 will operate normally with charged or uncharged batteries when powered by the AC Adaptor/ Charger, but batteries will only be trickle charged. If

the battery has been completely drained, then it must be charged for approximately 3 - 5 minutes before the unit may be used.

CAUTION: When using the AC Adaptor/Charger (Model 22 for 115 VAC or Model 23 for 230 VAC), it is recommended to plug the unit into the front panel of the Model 65/60 prior to inserting it into the AC source.

A small arc may result if these instructions are not followed. This arc will not damage either the Model 65/60 or the AC Adaptor/Charger unit.

1.5 Technical Specifications

Size	Height:	5"	(12.7 cm)
	Width:	3 3/4"	(9.52 cm)
	Depth:	1 3/4"	(4.45 cm)

Weight----------1 Pound (454 grams) including battery.

Housing----------Heavy duty polpropylene injection molded case with integral hinge.

Front Panels-------Anodized aluminum.

Power----------One 9-volt rechargeable nickel-cadium battery is required. Power consumption varies with the number of LEDs illuminated. Battery capacity is 100 mA hours, therefore, the battery life is 88 minutes (max.) with no Leds on, and 43 minutes (min.) when all front panel LEDs are illuminated. An AC Adaptor/Charger is required during extended use.

Input Signals------±25V per EIA RS-232 specifications.

Output Signals-----TD OUT and SCTE OUT will drive the EIA interface line with nominal data levels of ±8.5V (batteries at full charge). Output slew rate is 13V/microsecond.

2.0 MODEL 65/60 CONTROLS

2.1 General

This section describes all controls, displays, and connectors on the Model 65/60.

2.2 SCTE Out, +Out, -Out

SCTE Out: An external transmitter clock, selected by the data rate switch, is available at this jack. Selectable data rates are: 1200, 2400, 4800, 9600, and 19,200 bps.

+Out: The voltage at this jack is a continuous positive output voltage. This jack may be used whenever a Space or On signal is required.

-Out: The voltage at this jack is a continuous negative output voltage. This jack may be used whenever a Mark or Off signal is required.

2.3 Bus

Two bus bars with three jacks each are provided for fan-out jumper connections.

2.4 Async-Sync

When this two-position slide switch is in the Async position, the unit will operate asynchronously at selectable data rates of 75, 150, 300, 600, 1200, and 1800 bps. When the switch is in the Sync position, the unit will operate synchronously at any externally timed data rate up to 56,000 bps.

2.5 Power Off/Battery Charger

The Power Off, two-position slide switch is used to energize the Model 65/60 Bit Error Rate Tester and EIA Breakout Panel. The battery charger miniature-jack receptacle is used to recharge the batteries and power the unit from a 115 VAC or 230 VAC line using an AC Adaptor/Charger.

2.6 Async/SCTE

The Async/SCTE switch is a five-position switch which selects asynchronous data rates of 75, 150, 300, 600, or 1200 bps and SCTE data rates of 1200, 2400, 4800, 9600, or 19,200 bps.

2.7 Pattern

A four-position slide switch selects one of the following patterns to appear at the TD Out jack: 2047, 511-, 63-bit repeating pseudo-random or alternating mark-space.

2.8 Inject Errors

When this two-position slide switch is in the Inject Errors position, a single bit-error is injected into any of the four patterns of transmitted data appearing at the TD Out jack at a rate of two errors every second.

2.9 Reset/Resync/Display Test

This pushbutton resets the three-digit LED display and overflow indicator, resynchronizes the received data with the data receiver, and tests all the segments of the three-digit display.

2.10 Errors/Transitions

This three-digit LED display shows the total bit errors or transitions detected at the RD/EXT In jack.

2.11 RD Switch

When this three-position slide switch is in the center (RD) position, the data analyzer will detect, count, and display bit errors in the received pseudo-random or alternate pattern. When the switch is in the left or right positions, the data analyzer will detect, count, and display mark-to-space or space-to-mark transitions, respectively.

2.12 RD/EXT In

This jack is the input to the data receiver section.

2.13 TD Out

The output of the pseudo-random and alternating mark-space pattern generator is available via this jack.

2.14 RC In

This jack accepts an external clock input to drive the data analyzer section of the Model 65. This input is utilized only when the Async-Sync switch is in the Sync position.

2.15 TC In

This jack accepts an external clock input to drive the transmitter section of the Model 65. This input is utilized only when the Async-Sync switch is in the Sync position.

2.16 Signal Jacks

Located on each side of each DIP switch, they allow monitoring and cross-patching of all interface signals to each other and to the Model 65.

2.17 LED Indicators

Twelve LEDs on the Model 60 monitor the key interface signals: TD, RD, RTS, CTS, DSR, DCD, TC, RC, DTR, SQ, RI, and Busy.

2.18 To DCE Connector and Cable

A male 25-pin EIA connector, attached to a 9 3/4 inch ribbon cable, used to directly connect the Model 60 to data communication equipment (DCE).

2.19 Miniature Switches

Twenty-four switches allow each interface conductor (except Frame Ground on Pin 1) to be individually interrupted for isolated testing, observation, and cross-patching.

2.20 In+ and In- Circuits

Measures input signals and lights LEDs if they meet EIA RS-232-C or CCITT V.24 specifications.

2.21 To DTE Connector

A female 25-pin EIA connector used to connect the Model 60 to data terminal equipment (DTE).

2.22 Jumper Cables

Used for cross-patching signal lines. Two clips are provided for storage.

3.0 EIA RS-232 INTERFACE

The EIA RS-232 Interface is the U.S. set of signal protocol standards as specified by the Electronic Industries Association for DCE (Data Communication Equipment) - DTE (Data terminal Equipment) connections. The international standard for the same interface is CCITT V.24. The need for this universal standard is apparent, due to the many vendors of data communication equipment.

The hardware interfacing is performed within the electronics of the modem. However, this discussion will be limited to an interfacing protocol that occurs at the modem's (DCE) EIA connector. An EIA cable is used to connect the terminal (DTE) to the modem. This EIA cable employs 25 signal conductors, with each lead identified by a number. The EIA/CCITT standards define the function for each signal conductor and corresponding pin. See Table 3-1. Figure 3-1 shows the voltage thresholds for signal lines per EIA specifications.

It would be unusual for a system to use all 25 signal conductors. A typical interface will use approximately one-half of the available functions, based on the designer's application, and the remaining leads would be ignored. See Figure 3-2.

The EIA interface can be divided into three types of functions: control, timing, and data. Control signals make up the so called "EIA hand-shaking signals" that take place between the modem and terminal; these signals are either "On" or "Off". Timing signals control the data rate and synchronization of the data transfer. Data signals represent the actual transmission of information.

Before data can be transmitted or received, certain conditions must be met. First the terminal must place the Data Terminal Ready (DTR) signal on Pin 20 to the "On" state. This control signal tells the modem that the terminal is powered up, is not in a test mode, and is ready to be connected to the communication channel. The modem now places the Data Set Ready (DSR) signal on Pin 6 to the "On" state. This control signal, similar to DTR, tells the terminal that the modem is powered up and is not in a test mode.

The conditioning of these control signals does not mean that data can be transmitted. Depending on the particular telephone line (dial-up or point-to-point) the modem may be required to do more signaling before data can be passed.

But assuming both Ready functions are on, two additional signals must be enabled before data is transmitted. When the enter key on the terminal is pressed, the terminal turns on the Request to Send (RTS) control signal

Table 3-1. EIA/CCITT Interface Description

PIN #	MNEMONIC NAME	DIRECTION TO DTE	DIRECTION TO DCE	CIRCUIT EIA	CIRCUIT CCITT	DESCRIPTION
1	FG			AA	101	FRAME GROUND - This lead is an electrical equipment frame and power ground.
2	TD		→	BA	103	TRANSMITTED DATA - This lead carries the serial digital data transmitted from the DTE to the DCE.
3	RD	←		BB	104	RECEIVED DATA - This lead carries the serial digital data received at the DTE.
4	RTS		→	CA	105	REQUEST TO SEND - An "ON" condition on this lead is used to enable the local DCE for data transmission.
5	CTS	←		CB	106	CLEAR TO SEND - An "ON" condition on this lead indicates whether or not the DCE is ready to transmit data.
6	DSR	←		CC	107	DATA SET READY - An "ON" condition on this lead indicates that the local DCE is ready to process data and is not in a test, talk, or dial mode.
7	SG			AB	102	SIGNAL GROUND - This lead establishes the common ground reference potential for all circuits except frame ground on pin 1.
8	DCD	←		CF	109	DATA CARRIER DETECT (Received Line Signal Detector)- This lead indicates that data from the remote location is being received and meets a suitable criteria established by the DCE manufacturer.
9		←				Positive DC Test Voltage
10		←				Negative DC Test Voltage
11	QM	←		BELL	208A	EQUALIZER MODE - This lead is used to indicate to the DTE that the adaptive equalizer in the receiver is reset automatically when error performance is poor. (non-EIA designated).
12	(S)DCE	←		SCF	122	SECONDARY DATA CARRIER DETECT - This lead is equivalent to DCD on pin 8 except that it indicates the proper reception of the secondary channel line signal instead of the primary channel received line signal.

Table 3-1. EIA/CCITT Interface Description (continued)

PIN #	MNEMONIC NAME	DIRECTION TO DTE ←	DIRECTION TO DCE →	CIRCUIT EIA	CIRCUIT CCITT	DESCRIPTION
13	(S)CTS	←		SCB	121	SECONDARY CLEAR TO SEND - This lead is equivalent to CTS on pin 5 except that is indicates the availability of the secondary channel instead of indicating the availability of the primary channel to transmit data.
14	(S)TD		→	SBA	118	SECONDARY TRANSMITTED DATA - This lead is equivalent to TD on pin 2 except that is is used to transmit data via the secondary channel.
	NS		→	BELL 208A		NEW SYNC - This lead may be used on an optional basis with the DCE at a master station of a multistation private line network, such as in a polling operation, to ensure rapid resynchronization of the receiver on data from many different remote transmitters (non-EIA designated).
15	TC	←		DB	114	TRANSMITTER CLOCK - This lead is used to provide the DTE with signal element timing information.
16	(S)RD	←		SBB	119	SECONDARY RECEIVED DATA - This lead is equivalent to RD on pin 3 except that is is used to receive data on the secondary channel.
	DCT	←		BELL 208A		DIVIDED CLOCK, TRANSMITTER - A square-wave signal at one-third the nominal bit rate appears on this lead whenever power is supplied to the DCE. (non-EIA designated).
17	RC	←		DD	115	RECEIVER CLOCK - This lead is used to provide the DTE with received signal element timing information.
18	DCR	←		BELL 208A		DIVIDED CLOCK, RECEIVER - A square-wave signal on this lead provides the receiver timing information at one-third the nominal bit rate. (non-EIA designated).
19	(S)RTS		→	SCA	120	SECONDARY REQUEST TO SEND - This lead is equivalent to RTS on pin 4 except that is requests to use the secondary channel instead of the primary data channel.

Table 3-1. EIA/CCITT Interface Description (continued)

PIN #	MNEMONIC NAME	DIRECTION TO DTE ←	DIRECTION TO DCE →	CIRCUIT EIA	CIRCUIT CCITT	DESCRIPTION
20	DTR		→	CD	108.2	DATA TERMINAL READY - An "ON" condition on this lead indicates that the DTE is ready to be connected to the communication channel.
21	SQ	←		CG	110	SIGNAL QUALITY DETECT - This lead is used to indicate whether or not there is a high probability of an error in the received data.
22	RI	←		CE	125	RING INDICATOR - An "ON" condition on this lead indicates that a ringing signal is being received on the communication channel.
23			→	CH	111	DATA RATE SELECTOR - This lead is used to select between the two data signalling rates in the case of dual rate DCE.
		←		CI	112	DATA RATE SELECTOR - This lead is used to select between the two data signalling rates in the case of dual rate DCE.
24	TC		→	DA	113	EXTERNAL TRANSMITTER CLOCK - This lead is used to provide the transmitting signal converter with signal element timing information.
25			→	BELL 208A		BUSY - This lead is used for testing purposes by Telephone Company personnel. (non-EIA designated).

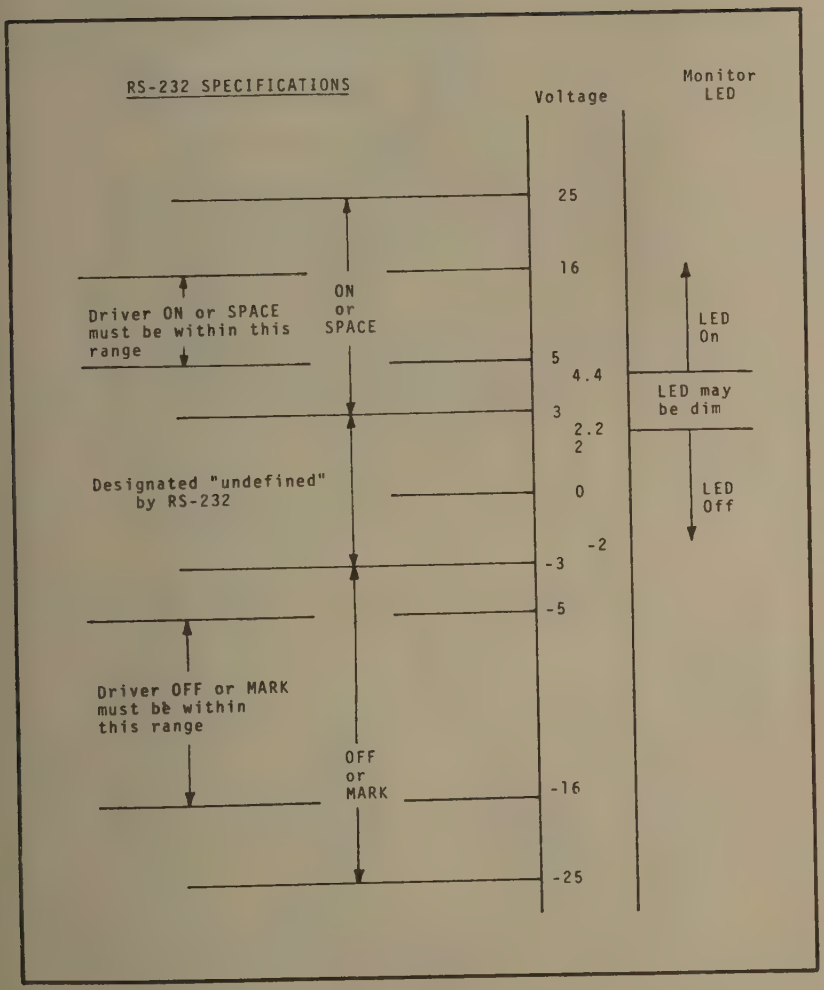


Figure 3-1. Voltage Thresholds for EIA RS-232/CCITT V.24 Lines

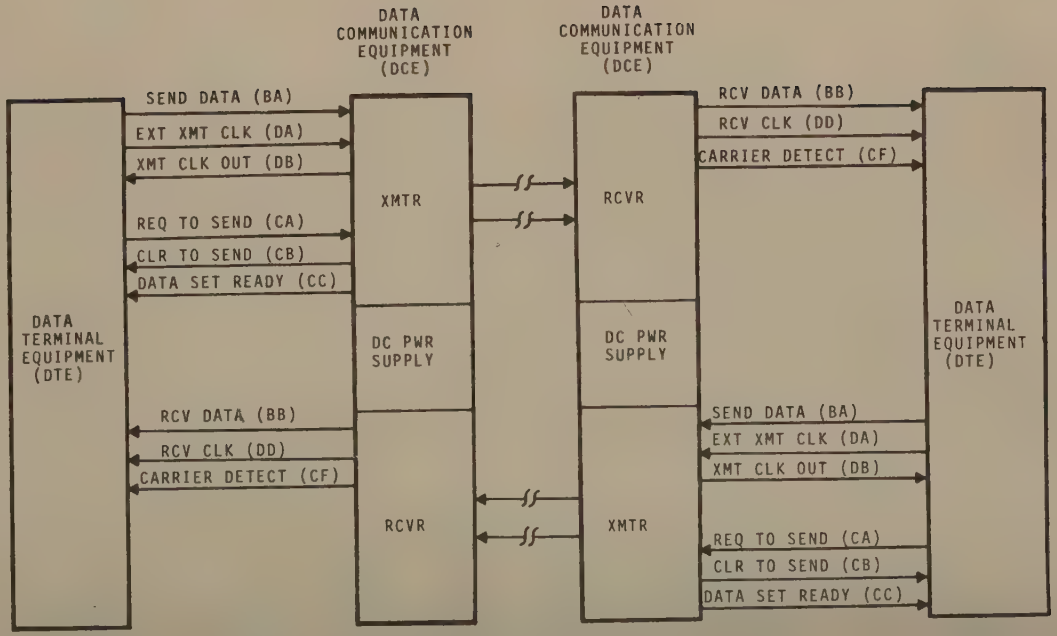


Figure 3-2. Typical System Application

(Pin 4) and tells the modem to prepare to send data as soon as possible. The remote modem then synchronizes itself with the local modem by adjusting the equalizer, receive clock, and automatic gain control. After a preset time, the local modem turns on the Clear to Send (CTS) signal (Pin 5) which tells the terminal that conditions have been met to begin transmitting data.

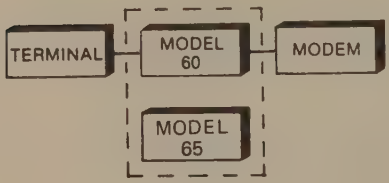
The Transmitter Clock (TC) signal, supplied by the modem (Pin 15) or by the terminal (Pin 24) provides synchronization between the modem processing the transmitted data and the terminal sending it. Another clocking signal, Receiver Clock (RC) (Pin 17), provides received data signal timing.

This brief introduction to the EIA/CCITT Interface is meant to be helpful in understanding the signal protocols that take place between the modem and terminal so the Model 65/60 can be used more effectively.

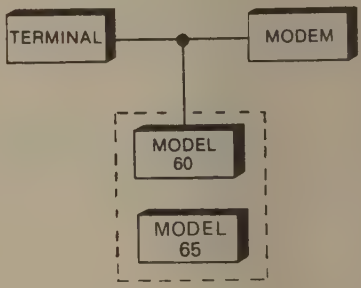
4.0 APPLICATIONS

4.1 General

The Model 65/60 can be used in various test configurations to isolate many data communications problems. This section will describe various common test procedures for using the Model 60 alone and in combination with the Model 65. Figure 4-1 illustrates various test configurations used in the following applications.



a. In-Line Mode



b. Monitor Mode

c. Modem Test Mode

Figure 4-1. Model 65/60 Test Configurations

4.2 Monitoring the Modem-Terminal Interface

In this application, the Model 60 is transparent to the interface while allowing the operator to monitor and breakout all 25 signal conductors. The unit is connected to the interface as illustrated in Figure 4-1(a).

SETUP:

1. Disconnect the EIA interface cable from the modem and plug it into the "TO DTE" connector of the Model 60.
2. Use the Model 60's ribbon cable, labeled "TO DCE", to connect the Model 60 to the modem.
3. Switch all Model 60 ON/OFF switches to the ON position.

4.3 Monitoring EIA Line Transitions

Having set-up the Model 60 to monitor the interface, the operator may now monitor transitions of any EIA signal conductor. The two LEDs associated with the IN+ and IN- inputs are used for this test. Each LED will light when the monitored signal changes between high and low states.

SETUP:

1. Connect the Model 60 to the interface as described in paragraph 4.2.
2. Use the three-way jumper cable to connect TD, Pin 2 (or any other signal line) to both the IN+ and IN- inputs.
3. Observe signal transitions.

4.4 EIA Line Voltage Test

The IN+ and IN- circuits of the Model 60 may also be used to measure the voltage level of EIA signals to determine whether they meet EIA specifications. The IN+ LED will light only if the monitored input signal is between +3V and +25V. The IN- LED will light only if the monitored input signal is between -3V and -25V.

SETUP:

1. Connect the Model 60 to the interface as described in paragraph 4.2.
2. Use a miniature jumper cable to connect any signal line to the IN+ or IN- inputs.
3. Observe LED indication.

4.5 Modem Loopback Test

In this application, the Model 60 is used to perform a digital loopback test on modems with no loopback capability. Transmit data (TD, Pin 2) is looped into receive data (RD, Pin 3) at the digital side of the modem using a jumper cable and the Model 60.

SETUP:

1. Connect the Model 60 to the interface as described in paragraph 4.2.

2. Switch the Model 60's #2 and #3 ON/OFF switches to the OFF position.

3. Use a miniature jumper cable to connect Pins 2 and 3 together on the DCE side of the switches.

4. Observe modem LED monitors to verify proper operation of transmitter and receiver circuitry.

4.6 Null Modem and Non-Standard Interface Cabling

The Model 60 can be used where special cross-wired interface cables are required to connect a terminal to a modem. Signal conductors are cross-patched by positioning jumper cables and opening switches to meet the required interconnect specifications.

SETUP:

1. Connect the Model 60 to the interface as described in paragraph 4.2.

2. Switch all Model 60 ON/OFF switches to the OFF (open) position.

3. Use jumper cables to cross-patch signal conductors as required.

4.7 Model 60 Lamp Test

The Model 60's LED circuits may be tested by simply connecting a jumper cable to the IN- pin and then to any of the other thirteen (13) LED circuits. An illuminated LED verifies proper circuit operation.

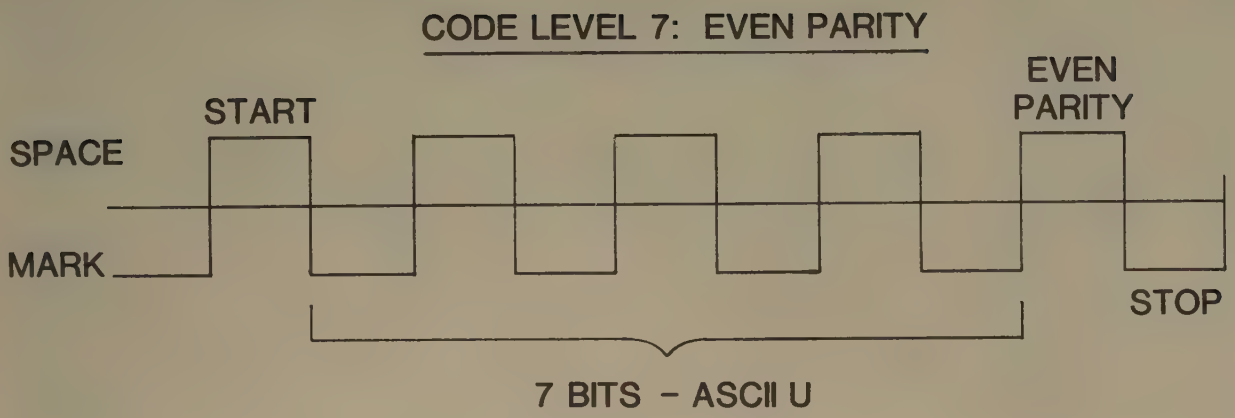


Figure 4-2. Model 65/60 ALT Pattern ASCII Character Generation

4.8 Asynchronous Bit Error Rate Test

The Model 65 can be used to perform a bit error rate test (BERT) on asynchronous modems and corresponding data links. Access to the modem interface signals is accomplished using the Model 60. The unit is connected to the interface as illustrated in Figure 4-1(c).

For systems requiring an ASCII start/stop character format, (i.e., asynchronous modems, statistical multiplexers, and TDMs), the ALT mark-space pattern generated by the Model 65 must be used. This pattern can be interpreted by the unit under test as a repeating ASCII character U. Figure 4-2 illustrates the Model 65's ALT pattern and how a system's code level and parity determines the ASCII character.

SETUP:

1. Turn Model 65 PWR switch OFF.
2. Disconnect EIA interface cable from the modem.
3. Use the Model 60's ribbon cable, labeled "TO DCE", to access the modem's EIA interface.
4. Switch all Model 60 ON/OFF switches to the ON position.
5. Use a jumper cable to connect RD/EXT IN jack (Model 65) to Pin 3, RD (on the DCE side of the Model 60's ON/OFF switches).
6. Jumper TD OUT (Model 65) to Pin 2, TD (Model 60's DCE side).
7. Jumper +OUT (Model 65) to Pin 4, RTS and Pin 20, DTR (Model 60's DCE side).
8. Position Model 65 control switches as follows:
   a. ASYNC/SYNC switch to the ASYNC position.
   b. Switch RD to the middle position.
   c. Switch INJECT ERRORS to the OFF position.
   d. Select desired PATTERN to be transmitted.
   e. Select required ASYNC data rate.
   f. Switch PWR ON.
9. Observe LED display for bit error rate analysis. The error count may be free running; momentarily depress RESET/RESYNC for one second to initialize test. If no error count (000) is displayed, continue to Step 10.
10. Errors may be injected into the transmitted pattern to verify transmission link continuity. Switch INJECT ERRORS ON, and observe an error count of two per second. Single errors may be injected by toggling the switch ON and OFF. If no error count results, verify proper test setup, and inspect modem configuration.

4.9 Synchronous Bit Error Rate Test

The Model 65 can be used to perform a bit error rate test (BERT) on synchronous modems and corresponding data links. Access to the modem interface signals is accomplished using the Model 60. The unit is connected to the interface as illustrated in Figure 4-1(c).

SETUP:

1. Perform Steps 1 through 7 of paragraph 4.8.

2. Jumper TC IN (Model 65) to Pin 15, TC (Model 60's DCE side).

3. Jumper RC IN (Model 65) to Pin 17, RC (Model 60's DCE side).

4. Position Model 65 control switches as follows:

   a. ASYNC/SYNC switch to the SYNC position.
   b. Switch RD to the middle position.
   c. Switch INJECT ERRORS to the OFF position.
   d. Select the desired PATTERN to be transmitted.
   e. Select the required SCTE data rate.
   f. Switch PWR ON.

5. Observe LED display for bit error rate analysis. The error count may be free running; momentarily depress RESET/RESYNC to initialize test. If no error count (000) is displayed, continue to Step 6.

6. Errors may be injected into the transmitted pattern to verify transmission link continuity. Switch INJECT ERRORS ON, and observe an error count of two per second. Single error may be injected by toggling the switch ON and OFF. If no error count results, verify proper test set, and inspect modem configuration.

4.10 Synchronous Bit Error Rate Test Requiring External Timing

In this application, the Model 65 is used to perform a bit error rate test on synchronous modems (and corresponding data links) requiring external timing. This setup is similar to asynchronous applications and uses the Model 65's SCTE (Serial Clock Transmitter External) output that provides timing at five selectable data rates.

The unit is connected to the interface as illustrated in Figure 4-1(c).

SETUP

1. Perform Steps 1 through 7 of paragraph 4.8.

SETUP: (continued)

2. Jumper SCTE OUT to the Model 65's BUS.

3. Jumper BUS to TC IN.

4. Jumper BUS to Pin 24, TCE (Model 60's DCE side).

5. Jumper RC IN to Pin 17, RC (Model 60's DCE side).

6. Position Model 65 control switches as follows:

   a. ASYNC/SYNC switch to the SYNC position.
   b. Switch RD to the middle position.
   c. Switch INJECT ERRORS to the OFF position.
   d. Select the desired PATTERN to be transmitted.
   e. Select the required SCTE data rate.
   f. Switch PWR ON.

7. Observe LED display for bit error rate analysis. The error count may be free running; momentarily depress RESET/RESYNC to initialize test. If no error count (000) is displayed, continue to Step 8.

8. Errors may be injected into the transmitted pattern to verify transmission link continuity. Switch INJECT ERRORS ON and observe an error count of two per second. Single errors may be injected by toggling the switch ON and OFF. If no error count results, verify proper test setup, and inspect modem configuration.

4.11 Transition Detector (Pulse Trap)

In this application, the Model 65 is used to monitor mark-to-space or space-to-mark transitions of any EIA interface line. Line transitions are counted and displayed on the LED readout. Access to the modem interface signals is accomplished using the Model 60. The unit is connected to the interface as shown in Figure 4-1(c).

SETUP:

1. Turn Model 65 PWR switch OFF.

2. Disconnect EIA interface cable from the modem.

3. Use Model 60's ribbon cable, labeled "TO DCE" to access the modem's EIA interface.

4. Jumper RD/EXT (Model 65) to any signal pin on the Model 60's DCE side.

5. Set the 3-position RD switch (Model 65) to the either left position to monitor mark-to-space transitions, or to the right position to monitor space-to-mark transitions.

4.11 Transition Detector (Pulse Trap) (continued)

6. Press RESET/RESYNC to initialize test.

7. Observe LED display count each line transition.

CALIBRATION AND REPAIR SERVICE

All units sold by International Data Sciences, Inc. are calibrated at the time of delivery. International Data Sciences, Inc. recommends a periodic calibration every six months thereafter performed by the Calibration Department at International Data Sciences, Inc. Contact IDS for the cost of each calibration. If the unit requires repairs that are not covered by the original warranty, then IDS will perform the repair at an hourly charge plus parts. Normal turn-around time for calibration is two weeks.

Equipment so calibrated will bear a gummed label on the rear panel identifying the serial number of unit calibrated; the date of calibration; the next recommended calibration date; and the in-plant calibrator identifier.

All units returned to IDS for calibration will be accepted only if transportation charges are prepaid. The purchaser is also responsible for all transportation charges incurred in returning the calibrated unit to the purchaser.

For fast service Federal or Emery Air Freight are recommended. If time is not a problem, UPS is recommended. Return address should be clearly stated and should include a person to the attention of whom unit will be shipped.

For most expeditious service, when returning the equipment for repair, please fill out the Trouble Report in your Manual of Operation.

WARRANTY

All International Data Sciences, Inc. products are warranted against defects in materiel, workmanship, and component failure for one year unless noted otherwise. All units repaired by IDS are warranted for 90 days following the repair service.

All units returned to IDS under this warranty require prepaid transportation charges. The purchaser is also responsible for all transportation charges incurred in returning the repaired unit to the purchaser.

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